1. Introduction and Specifications

The SIGMET, Incorporated, Model RCP02 provides a convenient interface between a modern weather radar system and advanced application software. All of the radar I/O and low-level antenna control are handled by the RCP02 which communicates with a host computer via a standard RS232 serial line. The application software on the host computer monitors the serial line for status information and issues high-level commands for control.

The flexibility of the RCP02 allows the unit to be connected to weather radar systems from different manufacturers. The RCP02 provides position and velocity servos for both the AZ and the EL axes of the antenna, the status monitoring of the transmitter/receiver/antenna servo systems and the control functions—Radiate On/Off and Servo On/Off. The standard RS232C interface can be connected to virtually any workstation or PC and is fully compatible with SIGMET's RVP7 signal processor and IRIS software system.

The features of the RCP02 are summarized in Table 1–1. Of special note are the fail-safe features of the RCP02 which are designed to protect the radar and antenna system in the event of a failure. The flexibility of the I/O design is based on SIGMET's 15 years of interfacing experience to different weather radar systems.

An optional feature is antenna stabilization for moving platforms, such as ships or airplanes. For shipboard use, the RCP02 accepts position, attitude and speed information from an inertial navigation unit (e.g., the Honeywell MAPS Hybrid system.) The antenna will scan in Earth coordinates regardless of the platform pitch, roll, or heading.

In this chapter:

1.1 General Architecture

The RCP02 is based on a GreenSpring Computers Platform 332™ MC68332 32-bit Microcontroller clocked at 16MHz. The circuit board is mounted on a SIGMET RCP02 main board that inserts into a standard 19″ EIA rackmount chassis. The GreenSpring board can accept Industry Package module cards (IP modules) for various functions, such as discrete/I/O, S/D convertor, A/D convertor, and HP–IB. This provides flexibility to adapt the RCP02 to different weather radar systems.

The front panel of the RCP02 houses a four-line by 20-character, vacuum-fluorescent flat panel display that exhibits the AZ/EL position, the velocity information, and the status in a variety of user' selectable formats.

The back panel contains an array of DB25F connectors for the I/O. The use of standard DB25 connectors makes it easy to obtain connector materials and fabricate mating connectors in the field. The functions for each connector are clearly labeled.

The unit is ruggedly constructed for demanding applications, such as shipboard use, and is equipped with auto-ranging power supplies to simplify installation.

Table 1–1: RCP02 Features and Specifications

General Architecture	Processor Board	GreenSpring Computers Platform 332™ MC68332 32-bit Microcontroller @ 16MHz
	Optional Boards	Up to 6 standard Industry Packs (IP Modules.)
	Main Board	SIGMET, Inc. Model RCP02
	Host Computer Interface	RS232C or RS422
	Firmware storage	ROM
	Configuration approach	Interactive terminal menus
	Configuration device	Standard VT100-style terminal or PC running terminal emulator connected on RS232C serial line. Alternatively, host computer supports configuration "chat" mode.
	Configuration storage	EEROM
	Local Control/Monitoring	Interactive terminal menu
	Host Computer Software Support	SIGMET IRIS system or software developed by user.

Table 1–1: RCP02 Features and Specifications, continued

Front Panel Display	Vacuum Fluorescent mounted on chassis front panel.
	4 lines x 20 characters
	17.8cm wide x 6.3cm high
	Character height 0.9cm
	Configurable display lines using interactive menu (AZ and EL position, velocity, and radar status line are typical.)
	Adjustable update rate and brightness level.
Antenna Control/Status	AZ and EL Position Servos configured in software setup.
	AZ and EL Velocity Servos configured in software setup.
	EL software limits (high/low) based on EL position servo.
	Servo On/Off Control (TTL or switch closure)
	Servo On/Off Status Input (wide-range DC input)
	Angle Input via synchro, TTL binary, or BCD.
	Analog tachometer input with adjustable range to $\pm$150V.
	Analog servo error (drive) voltage output with adjustable range to $\pm$12V.
	Antenna Local Mode switch input.
	Absolute tachometer calibration.
	Antenna alternate-control relay signal output (e.g., to switch drive signals to external handwheel control.)
	16-bit AZ and EL angle output typically used for synchronizing external signal processor (e.g. SIGMET RVP7.)
	Local control mode via terminal menu.
Radar Control/Status	Standard status monitoring inputs include: T/R power, radiate standby, radiate on, pulse width, magnetron current, wave guide pressure, cooling airflow, interlock, and pulse width (up to four.)
	Standard control outputs include: T/R power On/Off, Radiate On/Off (TTL or switch closure), equipment reset signal, and pulse width (up to four.)
	8 uncommitted user-status inputs used for BITE monitoring.
	8 uncommitted user-control output bits.
Fail Safe Protection	EL soft limits (high/low) watchdog algorithm
	EL shutdown limits (high/low)
	EL limit switches hardwired to diode clamping circuits in the drive outputs.
	Tach-check watchdog algorithm
	Antenna response-watchdog algorithm
	Antenna maximum-speed watchdog algorithm
	Antenna Local Mode Switch disables drive outputs.

Table 1–1: RCP02 Features and Specifications, continued

Optional Shipboard Platform Features	Stabilization Approach	Stabilization algorithms scan the antenna in earth coordinates using digital AZ and EL velocity and position servos.
	Platform motion sensor input	Position and attitude inputs from inertial navigation or gyro system on SDLC serial line (pitch, roll, heading angles and rates, absolute platform position, and velocity.)
	Range of operation	Typical 0 to 65 elevation (earth relative) for up to 15^{o} of attitude change. **Note**: Antenna pedestal should be capable of ~ -20^{o} of elevation.
	Typical performance	0.1^{o} of accuracy for elevation angles in the range 0 to 65^{o} for inclinations, up 15^{o} over 10 second periods. Exact performance depends on servo drive performance.
	Built-in display features	Selectable earth or pedestal relative AZ/EL position and/or velocity. Also Lat/Lon.
Input/Output	Angle Inputs	Digital: 16-bit binary, BCD or Analog: synchro signals.
	Tach Inputs	Analog up to ±150V
	Servo Error Drive Outputs	±12V @ 50mA
	EL Limit Switches	TTL or switch closure
	Status Bit Input Range	Wide range ±50V, triggering at +2.5V. 33K–Ohm impedance. Pull-up to +5V configurable by jumper (e.g., for switch closure input.)
	Standard Control Line Output Range	TTL or switch closure configurable by jumper.
	User Control Line Output Range	TTL
	I/O Connector Type	DB25F connectors mounted on chassis backpanel.

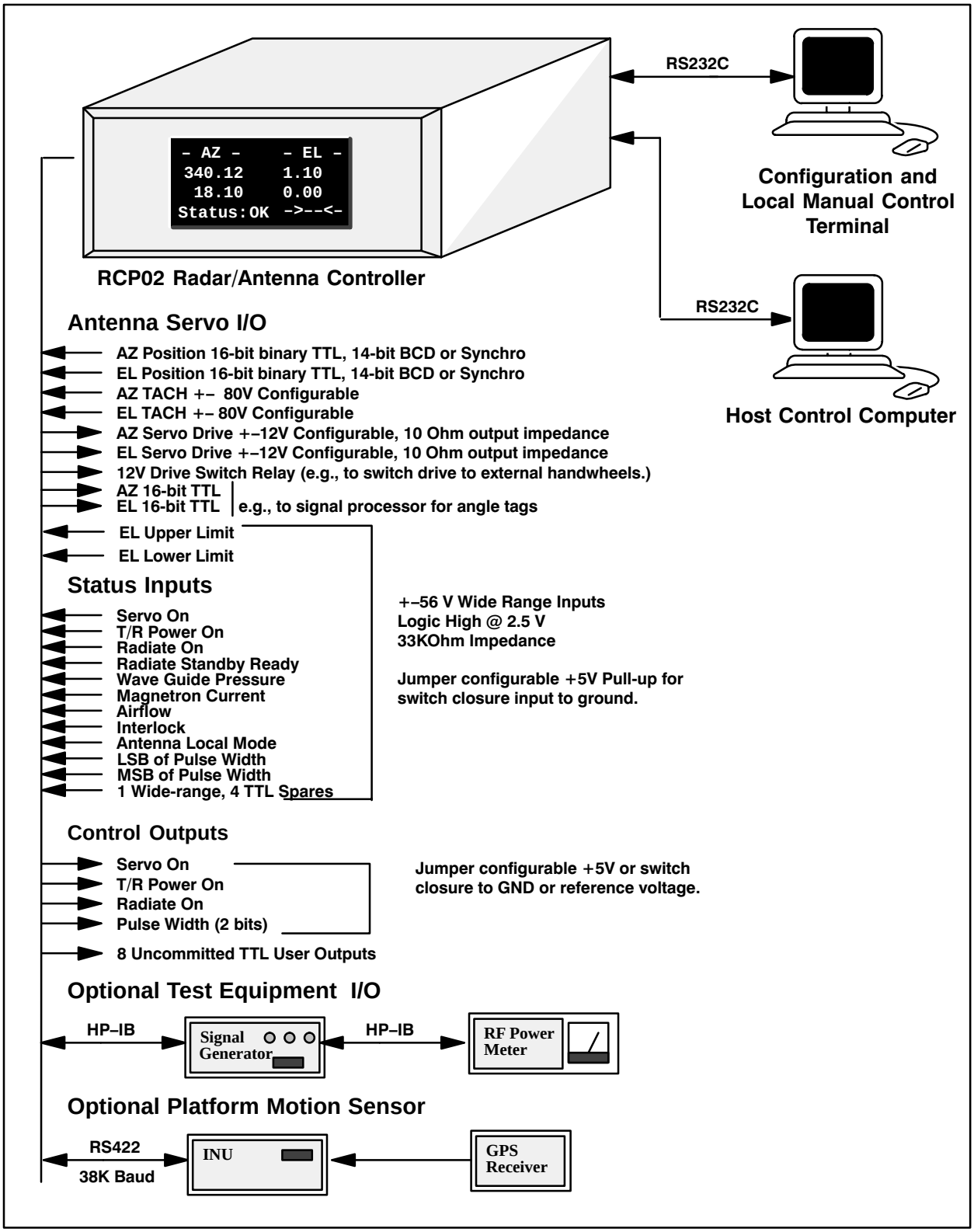
Table 1–1: RCP02 Features and Specifications, continued

Industry Pack (IP) Modules	Standard Modules	1–D/A, A/D Module 1–Discrete I/O Module
	Optional Modules	S/D Convertor Module HP–IB Module SDLC for INU interface
Chassis	Input Voltage	85–264VAC; 110–330VDC Autoranging
	Input Frequency	Range 47–440Hz
	Operating Temperature	0 to 50^{o}C Ambient
	Storage Temperature	-40 to $+75^{o}$ C
	Operating/Storage Humidity	0 to 90% non-condensing
	Safety	Designed to meet UL 1950 & IEC 950. Compenents are UL, CSA, and VDE compliant.
	EMI	The chassis uses integral shielding and line filters designed to limit emissions and susceptibility to interference from other devices. Power supplies designed to meet FCC and VDE "Class B."
	Cooling	Forced Convection using two 84 m^3/hr (50cfm) fans.
	Weight	13.6 kg (30 lbs.)
	Dimensions	Width: 432 mm (17″) Depth: 495 mm (19.5″) Height: 134 mm (5.25″) Standard EIA 19″ rackmount
	Construction	Case: welded aluminum alloy Back: cold rolled steel

1.2 RCP02 I/O Connections

The RCP02 unit is typically rackmounted in a standard 19-inch rack and connections are made to the back panel. The illustration, in Figure 1–1 on the following page, describes the I/O connections and functions including how the unit fits into a typical weather radar system design.

Figure 1–1: Example of RCP02 Applications



1.2.1 Local Configuration and Manual Control Terminal

A standard VT100-style terminal is used for local configuration and control. The terminal is connected on an RS232C interface at 9600 baud and is used for configuration and testing. Configuration is done via screen menus with the results stored in EEROM. Factory default settings are provided. For most systems, the terminal control eliminates the need for separate handwheels.

1.2.2 Antenna Servo I/O

Standard position inputs for AZ and EL can be up to 16-bit binary angles or four-digit BCD. Synchro inputs are offered as an option and interface to the S/D convertors supplied as IndustryPack modules.

Tachometer inputs for AZ and EL are analog-signed voltages up to 80V. The A/D convertor span, for the tachometers, is field adjustable by jumper for coarse adjustment and potentiometer for fine adjustment.

AZ and EL limit switch inputs can be either switch closures or wide-range DC inputs. The limit switch signals are used in a hardwired diode clamping circuit to cut the servo drive output in the event of a limit switch encounter. This will also protect the antenna if the RCP02 fails.

The drive output signals from the RCP02 go to the system servo amplifiers—the maximum range is ±12V with 10–Ohm output impedance. The output voltage for each channel is configurable by potentiometer.

The alternate drive relay signal is designed to connect to a 12-volt relay coil. This relay can be used to switch the drive outputs between the RCP02 and an external drive system, such as handwheel controls.

AZ and EL TTL position outputs are also provided—up to 16-bit binary. These outputs are typically used for synchronizing external equipment, such as a signal processor (e.g., the SIGMET RVP7), and are Earth relative angles for stable platform applications.

1.2.3 Status Inputs

The RCP02 receives status indicators from both the radar and the servo system. The following standard status lines are supported:

- Servo On/Off
- T/R Power On/Off
- Radiate On/Off
- Radiate Standby ready
- Wave Guide pressure

- Magnetron current
- Airflow/Cooling
- Pulse width (two bits for up to four pulse widths)
- Antenna Local Mode switch

These inputs can be any combination of switch closures (with pull-ups configured by jumper), or wide-range inputs, up to 50V with a logic high at + 2.5V. The sense of the inputs is configurable in software.

1.2.4 Control Outputs

The following represent the standard control outputs supported by the RCP02:

Servo On/Off

- T/R Power On/Off
- Radiate On/Off
- Pulse width (two bits for up to four pulse widths)
- Reset signal (to reset external devices)

These outputs can be either TTL or switch closures, such as to ground. The type of output is configurable by jumper. The sense of the output (high/low) is configurable in software.

Optional HP–IB for Test Equipment

The RCP02, Rev 2 and higher, supports an optional HP–IB interface to control and monitor the external test equipment. This includes a test signal generator for remote controlled calibration and a power meter to monitor transmit power.

Optional Inertial Navigation Unit Interface for Shipboard Applications

When a radar is placed on a ship or an airplane, the RCP02 can stabilize the antenna to scan in Earth coordinates. The platform attitude and position information is input in a RS422 serial line that is typically an inertial navigation system, such as the Honeywell MAPS Hybrid unit. This unit uses a GPS receiver to obtain periodic position updates to compensate for INU drift.

Host Computer Interface

The host computer interface is a RS232C serial line. There are several protocols that are supported, depending on the application. All of the protocols support the sending of commands to the RCP02 and receiving status information back from the RCP02. These are documented in Appendix A of this guide.

In addition, the RCP02 can operate in a "chat" mode with the host computer This enables the configuration to be changed directly from the host without the need to connect a configuration terminal. For all networked environments, this feature allows remote configuration of the RCP02 from any networked workstation.